

Minutes of the Meeting of the Fusion Energy Sciences Advisory Committee

February 19-20, 2008
Marriott Hotel, Gaithersburg, MD

Members present:

Dr. Charles Baker, Sandia National Laboratories
Prof. Riccardo Betti, University of Rochester
Dr. Richard Callis, General Atomics
Dr. Jill Dahlburg, Naval Research Laboratory
Dr. Martin Greenwald, Massachusetts Institute of Technology
Prof. Richard Hazeltine, University of Texas-Austin
Prof. Joseph Johnson, Florida A & M University
Dr. Rulon Linford, Lawrence Livermore National Laboratory
Dr. Kathryn McCarthy, Idaho National Laboratory
Prof. Gerald Navratil, Columbia University
Prof. Stewart Prager (chair), University of Wisconsin-Madison
Dr. John Sheffield, University of Tennessee, Institute for a Secure and Sustainable Environment
Prof. Edward Thomas, Auburn University
Dr. Michael Zarnstorff, Princeton Plasma Physics Laboratory

Members absent:

Prof. Jeffrey Freidberg, Massachusetts Institute of Technology

Ex-officio members present:

Prof. Ian Hutchinson (APS-DPP), MIT
Dr. Roger Stoller (ANS), Oak Ridge National Laboratory
Dr. John Steadman (IEEE), University of South Alabama

Ex-officio members absent:

None

Designated Federal Officer present:

Albert Opdenaker III, Executive Assistant for Fusion Energy Sciences, US Department of Energy

FESAC Executive Secretary:

Dr. John Sarff, University of Wisconsin-Madison

Other persons attending the meeting are listed in the appendix.

1. Meeting Agenda and Logistics.

The meeting was called to order at 9:00 am. Prof. Prager introduced Prof. Ian Hutchinson as the new ex officio member representing the APS Division of Plasma Physics.

2. Office of Fusion Energy Sciences Perspective.

Dr. Raymond Fonck, Associate Director, provided an update on the Office of Fusion Energy Sciences (OFES) program. Dr. Fonck summarized the FY 2009 budget request and program changes. Full funding of ITER is requested, following the difficult FY 2008 appropriations that included very little ITER funding. The ITER project is in “survival mode” by maintaining a minimal core team and deferring cash contributions, design R&D, and hardware procurements. Major facility operations and research would be reduced in FY 2009, intended to be a one year hit. Two concept exploration level facilities have been terminated, the SSPX spheromak experiment at LLNL, and the QPS project at ORNL. The NCSX project would continue, assuming successful rebaselining. The proposed FY 2009 budget would also support modest new initiatives: initiation of the Fusion Simulation Project, support for strategic planning activity for long-term initiatives, and a significant increase in the joint program for High Energy Density Laboratory Plasmas (HEDLP).

Dr. Fonck described a problem reflected in the FY 2008 budget discussion. As in recent years, the program was presented in two main categories, ITER and non-ITER. He believes this communicates the wrong message, that the burning plasma mission is not integrated into the program. He illustrated this with what could have been a more integrated presentation of the program, with three categories of research: burning plasma/tokamak, alternate toroidal configurations, and plasma science. He urged the community to also not view the program as ITER separate, noting that the Fusion Day talking points had also used ITER and non-ITER language.

Dr. Fonck described the status of the NCSX project. The project cost has expanded by about \$50M, with an approximate 29 month delay expected for the completion of the device. The increased cost has resulted from underestimates of the fabrication and assembly requirements. Also, “learning curve” savings did not materialize. Dr. Fonck summarized recent reviews, including the FESAC science review of the stellarator program. Additional reviews are planned. The conclusion of DoE is to support the completion of NCSX, assuming successful rebaselining.

Dr. Fonck then described the DoE decision to phase out the NSTX program in order to afford NCSX on a flat budget. The NSTX project would operate for two more years, possibly three if sufficient funds materialize. Dr. Fonck emphasized that the termination of NSTX does not imply the U.S. is abandoning interest in the Spherical Torus. The OFES has requested a plan from PPPL to address the most critical Spherical Torus science issues given the limited 2-3 years of operation. Dr. Fonck complimented the NSTX team for their cooperation under difficult circumstances in identifying four highest priority research areas.

Dr. Fonck summarized the ITER project, which is now a legal entity. The organization is staffed at approximately 1/3 full strength. The Member’s Domestic Agencies have all been formally established. The ITER Organization (IO) has submitted the Preliminary Safety Report to the French regulatory authorities. The design review is concluded, but there are remaining technical

issues to resolve. The IO is developing a bottoms-up Integrated Project Schedule, with indications that the completion of ITER construction will likely slip to 2019. The shortfall in FY 2008 appropriations has forced the US ITER Project Office (USIPO) into survival mode. Funds have been identified which will continue to support secondees at USIPO. Three factors are driving an increase in ITER cost: (1) changes in requirements, scope and schedule, (2) exchange rate escalation, and (3) estimate maturity and additional contingency. The range for total project cost is now \$1.45B-\$2.2B (U.S. share). Dr. Fonck reported that the U.S. does not have resources to commit for participation in the ITER Test Blanket Module (TBM) Program. However, the U.S. has agreed to pay its 9.1% share of the added civil infrastructure costs needed to accommodate a TBM program. The U.S. is reserving the option to be a future collaborator in TBM research.

Dr. Fonck described the new, conceptual organization of OFES into three divisions: ITER and Projects, Magnetic Fusion Sciences, and Plasma Sciences. He noted the hope for breakout funding in Plasma Sciences in the future. Dr. Fonck reviewed the roadmap or strategic plan for Basic Energy Sciences as a potential model for strategic planning in OFES. He described the planning process underway for OFES programs, through a sequence of FESAC studies, future community workshops, and ending with a consolidation and prioritization process.

Dr. Fonck discussed outreach and communications to sponsors, colleagues, and others. He reports OFES is working to improve communication activities by establishing a cross-cutting group that would include public affairs professionals.

Dr. Fonck described staff openings in OFES, for division directors, technical staff, and support staff. He urged the community's help in finding good candidates for these positions.

FESAC discussion: There were several questions related to ITER. Since the U.S. is not participating in the TBM program, will the U.S. have access to the TBM intellectual property (IP), and what are partner views on TBM IP? Dr. Fonck replied that an ad hoc group is looking at the legal framework, and equal sharing of the TBM IP appears possible, the same as for other IP related to ITER. In response to a question of which sponsors are not convinced that the TBM is necessary, Dr. Fonck noted there is no particular threat, rather reluctance to provide more for ITER until the cost and schedule become clear. It was noted that 80% of ITER funding is in-kind contributions, which will not necessarily involve people already involved in the program. Dr. Fonck agreed, but noted that the guidance so far is to assume the American Competitiveness Initiative (ACI) will go forward. If so, this provides new opportunities in the future, for example building an ITER research team, but without ACI, there will be a problem. It was asked how to deal with the awkwardness of increased cost associated with ITER in dealing with congress, and whether or not U.S. interest in strong management is a positive factor. Dr. Fonck replied that next year will be more definitive, but that the budget request for FY 2009 will keep U.S. participation on track independent of cost in the end. He agreed that U.S. leadership in management is a positive factor, but that we must be respectful of our partners.

On the NCSX project, it was asked if issues related to cost and schedule overrun could impact the view on ITER cost and schedule. Dr. Fonck answered that the issues associated with NCSX are more one-of-a-kind, and that there is recent experience with the construction of large tokamaks.

When the ITER cost and schedule are in hand, the situation will be more secure. He noted a mistake in the NCSX project was its flat funding profile. A concern was expressed that referring to “transformational science” in regard to NCSX might raise too high expectations. Dr. Fonck explained that in this context transformational science means research that will resolve or relax important issues, for example disruptions in advanced tokamaks.

Several questions were raised on program organization and budget. It was observed that Dr. Fonck had emphasized a need for program presentation that emphasizes ITER integration, but that the proposed OFES organizational chart has a separate column for ITER. Dr. Fonck explained that the “ITER & Projects” division should be viewed “international and projects”. With respect to the proposed “Plasma Science” division, a concern was expressed that having OFES the main steward without additional resources could be dangerous if the goal is to support and grow basic plasma science. Dr. Fonck replied that we should take the NRC Plasma 2010 report seriously, and there should be openness to what is spent on basic science and what on fusion science. He agreed there is risk, but observes that other funding agencies are scaling back support of basic plasma science, and that if nothing is done, this area will wither. On the budget outlook, it was observed that expenditures for NCSX and ITER are going to be substantially larger, and that there is a desire to start smaller components of the program such as the Fusion Simulation Project (FSP). If the budget remains flat, how will this be managed? Dr. Fonck answered that, in this circumstance, moving science forward requires changing what you do. He emphasized we need to know where we want the program to go, then address how to achieve these goals through a strategic plan. Asked what he meant by “FSP is started,” Dr. Fonck answered this is \$2M in the FY 2009 OFES budget request, and for now no new funds from OASCR.

3. Department of Energy Perspective.

Dr. Raymond Orbach, Under Secretary for Science, provided an update on the FY 2009 budget request and Office of Science perspectives. In introductory remarks, Dr. Orbach stressed that the fusion program is at a critical point. He expressed concern that congress could redirect planned funds for fusion to other areas, with short term consequences. He assured FESAC that he and Dr. Fonck would be doing everything they could to give fusion a future, and asked the community for help and leadership. There is a \$0.75B increase for the Office of Science proposed, which is spectacular in its magnitude, making it possible for congress to balk. Dr. Orbach said the President has confidence in the science community, and he had never heard a president talk about science in a State of the Union address as occurred this year. He noted that funding for OFES in FY 2009 would increase 72%, and at stake is this order \$200M which that could support a future world class facility.

On ITER, Dr. Orbach noted that the U.S. is an intellectual leader as well as project management leader. The U.S. is working hard to keep ITER on budget and on schedule. He described possible means for additional ITER funding in 2008. It may help that ITER is the Office of Science’s highest priority. Additional funds did not get placed in the stimulus package, so another means will be required. He emphasized that it is essential to keep the U.S. ITER Office open, otherwise it will be very difficult to attend ITER Council meetings to impact project management. The FY 2009 budget request calls for \$214.5M for ITER, most of which is for in-kind contributions spent in the U.S., which should help in congress.

Dr. Orbach described progress with the National Ignition Facility (NIF) as going very well. He notes that Inertial Fusion Energy (IFE) will be given a “big shot in the arm” if ignition is attained in NIF. He discussed the prospect for NIF to be a user facility, and said he would be working with NIF leadership to try and make this happen (also on the Z and Omega facilities). There will be money in 2008 to support user meetings, to work toward NAS recommendations.

Dr. Orbach described the joint High Energy Density Laboratory Plasma (HEDLP) program. The funds will be pooled, with joint responsibility for administration. He said the defense related research on NIF needs to be realized with full input from the scientific community. He will work to integrate the university community into Inertial Fusion facility use.

Dr. Orbach thanked FESAC for the report on NCSX. The issues with budget and schedule overruns can call into question the credibility of Office of Science project management.

Dr. Orbach described the plan for future fusion research. He said the Office of Science will support only world leading effort. He pondered what the U.S. fusion program would be doing before ITER turns on, what should the program look like? He said the program needs to be robust and compelling, and the scientific case has to be presented to congress. He emphasized the need for prioritization.

FESAC discussion: Several questions were asked about Congress’ decision not to fund ITER, what message, if any, is being sent to the fusion program, and what might be done to address this issue. Dr. Orbach stated he thought it hard to believe the appropriations language was a last minute change, and that Congress chose to support short term projects in order to show that it cares about energy. He noted the challenge in making arguments for long term investment in science, but he stated strongly that he believes fusion is the only hope for an unlimited energy source that is environmentally benign. It was also asked whether or not anything can be done about the likely scenario the budget will be in continuing resolution. Dr. Orbach said he could not offer much advice, as the situation is more political than scientific. He agreed that it is prudent to expect a continuing resolution for order six months into FY 2009.

4. ITER Project Status.

Dr. Ned Sauthoff, Project Manager, U.S. ITER Project Office, discussed the status of ITER. The Design Review was concluded in Sept. 2007. Nevertheless significant technical issues remain. The Science and Technology Advisory Committee (STAC) has examined the Design Review and reported issues to the ITER Council. The Council has directed that the updated baseline design expected in June 2008 should address the 22 issues identified by the STAC. Dr. Sauthoff described in some detail three of the critical issues: (1) vertical stability, plasma shape control, and flux swing, (2) Edge Localized Mode (ELM) control, and (3) vacuum vessel and blanket loading conditions. The U.S. participation in resolving ITER issues is very strong, accounting for 23% of the effort, which is the largest fraction for any party. The U.S. is also working with the ITER Organization to assess the cost of changes in the design. Each party is responsible for estimating the cost evolution of its in-kind contributions. Dr. Sauthoff also described some of the challenges in creating effective project management and team dynamics. He noted this is not only an ITER Organization issue, rather involves all of the Domestic Agencies. He described

issues associated with export controls and information management, which is complicated by the varied views held by the different parties. Dr. Sauthoff also described effort in forming a research plan, which is the responsibility of the ITER Organization. Several U.S. scientists are involved in the process. The scope is still unclear, for example, should the plan cover the initial startup, or should it include a longer view, including considerations of upgrades? Dr. Sauthoff also described efforts to form an ITER research team, particularly noting the role of ITPA activities that were summarized.

FESAC discussion: In regard to the ITER research plan, it was asked what should be the role of the U.S. Burning Plasma Organization (BPO)? Dr. Sauthoff replied that the individuals formally involved in developing the plan should reach out to the community and be strongly integrated with BPO. It was asked how secure are the assignments to the U.S., and what is the status of discussions with U.S. industry? Dr. Sauthoff replied that the state of interaction with industry varies. The project is engaged with industry on the cooling water system, but not so much for other systems. The intent for this year was to begin prototyping and mockups, and a major casualty in the FY 2008 budget is industrial involvement. He said that as soon as more funds are available for the project, the USIPO is ready to issue contracts. A question was asked about the status of the superconducting strand that was reported to have technical issues. Dr. Sauthoff replied that four conductor samples have been manufactured in two cable configurations. The other ITER parties have made similar tests. It was noted in the breakdown of contributions to the ITER design review that Japan accounted for 5% of the contributions, and is this a concern? Dr. Sauthoff did not understand why Japan is not more engaged given that they are in a position to contribute. It was asked, looking at experience with other construction projects, what fraction of funding is required to get to the CD-2 level. Dr. Sauthoff said generally this is 25%. For ITER, it is \$0.4-\$0.5B out of \$1.4B-\$2B, which is bit on the high side. It was noted that Dr. Orbach stated it was likely the funding situation would be in continuing resolution; would it be possible to spend \$214M for ITER in six months as requested in the FY 2009 budget? Dr. Sauthoff replied that we are not in a position for this money to be spent, but we are in a position to commit it.

5. New Charge on Non-Tokamak Magnetic Fusion Concepts.

To establish the backdrop for the new charge to examine non-tokamak magnetic fusion concepts, Dr. Fonck presented a more general overview of program planning and next steps. He reviewed the method used by Basic Energy Sciences for strategic planning as a model for OFES, as well as the draft, conceptual new organization for OFES. He described a four-step process to strategic planning beginning with a strategic theme that evolves to a plan or science roadmap. The middle steps are issue identification via FESAC study and the development of approaches and initiatives by community workshops. The aim is not to have one overall strategic plan, rather four, one each for: magnetic fusion energy science, inertial fusion energy science, high energy density laboratory plasma science, and plasma science. The non-tokamak toroidal confinement research program is defined narrowly, and therefore ready for issue analysis. The HEDLP and plasma science components are not yet ready for this analysis. At some point inertial fusion energy will be separated from HEDLP, but it is not yet clear when. With respect to the tokamak program, Dr. Fonck described the next step in planning through workshops that “drill down” to identify the science and technology issues to address research gaps. Several workshops are envisioned, following the three themes laid out in the Priorities, Gaps and Opportunities panel (Greenwald panel), another assessing burning plasma science, and others that would follow from additional

FESAC charges. Dr. Fonck then described the draft charge on toroidal alternates, which includes stellarators, spherical tori, reversed field pinches, and compact tori. Other Innovative Confinement Concepts will appear elsewhere, some in the HEDLP program, some in the basic science division. The draft charge calls for identification and justification of long term goals for the toroidal alternates. It is anticipated that the methodology developed by the Priorities, Gaps and Opportunities panel would be employed for this new charge.

FESAC discussion: It was noted that there is overlap and coupling between the various themes and topics for the workshops. Also, it is possible that conceived facilities or initiatives would be pertinent to all workshops. How should this be handled? Dr. Fonck agreed that cross-cutting is a factor across the program, and that input on how to deal with this is welcome. He hopes the workshops arrive at concrete answers. It may be necessary to have a final integrating discussion. It was noted that there is a role for plasma science in “fusion plasma science”, e.g., basic nonlinear processes. Since the planning for these areas is separate, it is important to make sure this connection is recognized. Dr. Fonck replied that it would be good if the panel recognizes and pulls out these connections. It was observed that the titles for the BES basic research needs are very specific. Is this same level of specificity the goal of the planned workshops for OFES? Dr. Fonck replied that OFES is different in having relatively narrow goals than for BES, but he hopes that the workshops are specific. It was asked; does the alternates charge include a discussion of raising or lowering expectations for different concepts? Dr. Fonck replied that the panel will not be asked to address this; rather at this stage the aim is to identify the issues and gaps in knowledge, not to make a judgment on change. A concern was expressed on advocates talking with themselves to arrive at the process and end products. This may not be compelling to outsiders, and that it might be better to first formulate a set of cross-cutting questions that guide the process. Dr. Fonck replied that the charge calls for a critical evaluation of the long-term goals. The consolidation process to form a coherent plan would come later.

6. White Paper on University Involvement in Fusion.

Prof. Stephen Knowlton, Auburn University and University Fusion Association, presented a white paper on the *Role of Universities in the Burning Plasma Era*, which describes the opportunities and challenges for university research as a major focus of the fusion program becomes burning plasma science. Prof. Knowlton noted that universities are involved in most aspects of fusion research and add value through their naturally interdisciplinary and educational environments. The challenges for university programs are driven by the prospect for fewer and larger fusion facilities for which collaboration will be a principal university role. The white paper describes that effective collaborations must serve the needs of the host as well as the academic and intellectual needs of the university. The universities must have suitable on-site resources plus faculty, professional staff, and students engaged in the research. Given that burning plasma science has a 20 year and longer vision, the white paper envisions long term support ~ 10 years appropriate for effective collaboration. The white paper also notes that many universities are capable of leading or partnering in moderate and large-scale initiatives, and that keen interest exists in the universities to address the key science issues identified in ongoing prioritization. Prof. Knowlton described an exploratory workshop on University Fusion Initiatives that was held at MIT Feb. 14-15 at which 5 potential areas of interest were identified.

FESAC discussion: It was noted that the fostering of two-way collaboration has been previously identified as an important issue, for example the workforce study. Prof. Knowlton agreed, saying that finding some way to make this substantive would be good. It was also noted that substantial and successful university collaborations have and do exist in fusion research. The white paper makes it sound like not much has been done. Prof. Knowlton acknowledged this point and noted that several examples are described in the white paper. A comment was offered that, although the white paper's focus was university participation in burning plasma science, some mention of the important role of basic plasma science and small-scale experiments at universities would have been good. Prof. Knowlton agreed and offered to make sure the white paper was clear on this point.

7. Public comments (3).

Prof. Arnold Kritz, LeHigh University, commented on the peer review system for evaluating research proposals in OFES. He noted that fusion research is increasingly collaborative. Hence, it is becoming more difficult to find suitable reviewers (e.g., those without conflicts of interest). This difficulty is compounded by the policy to have all submitted proposals peer reviewed. Prof. Kritz noted that, during his tenure in OFES, he felt uncomfortable sending out some proposals for review when he expected they would not be funded. He argues this unduly burdens the reviewers of such proposals. He also noted that it was clear some proposals would be funded. Prof. Kritz suggests the review process is not working well. He noted that the standard of deviation in the proposal ratings is wider than the line separating the ratings of funded and unfunded proposals. Given the amount of effort dedicated to proposal reviews, he recommended giving consideration to improvements in the review process. He suggested giving program managers in OFES more control of proposal review decisions.

Prof. Rob Goldston, PPPL, gave a short presentation titled "Magnetic Fusion Energy: Why, When, and How?" He described a series of seminars on various approaches to energy (presentations available on the website nrg.caltech.edu). He noted that near term technologies can and must be used to stabilize carbon dioxide emissions over the next few years, but that these technologies are not adequate to address the long term problem. He cited arguments by Pacala and Socolow that in the long term there is a need to lower emissions (not just stabilize emissions). Fusion energy can help with the long term energy solution. So there is both a need for short term solutions, such as energy efficiency, as well as a need to solve a huge emission problem in the long term.

Prof. Miklos Porkolab, MIT, reported on the recently held AAAS meeting in Boston. He noted the special symposium on fusion was very successful and well attended, especially considering that it was held on a Saturday afternoon. He summarized the key points of the six speakers invited to speak on magnetic fusion energy.

First day, adjourned, 4:45 pm

Second day, called to order, 9:00 am

8. Frontiers in High Energy Density Physics: Overview of Two National Studies.

Prof. Ron Davidson, PPPL, described two national studies that identify research opportunities of high intellectual value in high energy density plasma science. These studies were conducted by

the National Research Council and by the Office of Science and Technology Policy's Interagency Working Group on the Physics of the Universe. "High energy density" describes a variety of physical phenomena at energy densities exceeding 10^{11} J/m³, or pressure exceeding 1 Mbar. Prof. Davidson illustrated and summarized many areas of research that span high energy density conditions. A number of illustrative challenges that were identified in the NRC study led to the Interagency Task Force on HEDP. This task force identified 15 research thrust areas, which Prof. Davidson summarized and illustrated with examples and laboratory capabilities to access the HEDP regime. He reported that a day and one half meeting dedicated to HEDP is planned for the April APS meeting which will include 30 invited papers.

FESAC discussion: It was noted that 5 to 6 years ago, HEDP as a science area could not survive without fusion aspects. Prof. Davidson replied that in many respects fusion is critical to HEDP. He noted near term scientific objectives that are not specifically fusion related, but applications pull the science along. It was noted that it has been challenging to share the plasma community's perspective of its science with other established fields. Prof. Davidson replied there has been significant progress, noting the plasma astrophysics topical group in APS and the successful HEDP workshops that led to the affiliation with the APS April meeting. He noted that in putting together the interagency task force, only one astrophysicist declined to join for schedule reasons, which indicates strong interest from the astrophysics community.

9. NNSA Perspective on HEDLP Joint Program.

Dr. Christopher Deeney, NNSA, described the NNSA's perspective on HEDP and the joint program. Nuclear weapons definitely involve high energy density physics, and NNSA's mission is to develop improved understanding and predictive models in the absence of nuclear testing. Hence HEDP is a critical discipline in NNSA. Dr. Deeney described various computational capabilities and experimental facilities, emphasizing validation of models and experimental discovery. NNSA created the Stewardship Scientific Academic Alliance and Graduate Fellowships (SSAA and SSGF) to encourage excellent academic research. These were formed mainly for workforce development. NNSA welcomes the joint HEDLP program, but it will not be executing its program through the joint program. NNSA also supports having FESAC input to HEDLP to help steward the program.

FESAC discussion: It was asked how much is spent on the SSAA and SSGF programs. Dr. Deeney replied \$24M, which covers a broad number of areas. In the next few years there will be \$5M-\$7M for new activities. When the joint program was formed, the \$12.5M included was for activity already ongoing. Existing grants will be competed in the joint program. It was asked; what are the plans for science campaigns for the broad scientific community? Dr. Deeney replied that Rochester has such plans, but Z and NIF do not. He noted that NIF will be a flagship for universities in the future, but now a NIF shot costs \$0.5M, and the risk for shots poorly planned and executed is too great. Also, NNSA is encouraging university centers to have more open access. A clarification of the sense that NNSA will not be executing its program through the joint HEDLP program was requested. Dr. Deeney replied that to first order they would not be looking to the joint program to solve problems, partly because they are classified. But he also noted that clearly there are research areas that would benefit both programs. The emphasis will be good HEDLP science. It was asked if there were examples of how HEDLP helps ensure a nuclear weapon will work. Dr. Deeney replied that in a weapon a primary energy source drives a

secondary energy source. How the energy moves is not fully understood, for example the equation of state. Laboratory research in HEDLP faces the same issues. It was noted that within OFES, burning plasma is a main goal. Is burning plasma one of the many goals of the weapons mission, or a very important goal? Dr. Deeney replied the burning plasma is the biggest gap in capabilities.

10. New Charge on High Energy Density Laboratory Physics.

Dr. Fonck described the OFES perspective on the draft charge for HEDLP. This charge has to be signed off by the Undersecretaries of both the Office of Science and NNSA. A formal Memorandum of Understanding must be in place for FESAC to act as an advisory board. The two Offices have interests that overlap but also diverge. Mainly NNSA wants to promote excellent HEDLP science. OFES is interested in HEDLP science and also as a possible energy application on a longer term. Dr. Fonck expects the HEDLP charge and planning process to follow the same paradigm as other planning activities. He notes that the basic grand challenges for HEDLP have been identified in the NRC report, Interagency Taskforce, and community workshops. Additional funding for HEDLP has been requested for FY 2009 given urgency to get the process going. However, Dr. Fonck notes that what happens in FY 2009 will not set the overall process. Nothing is definite until the charge is received from the Undersecretaries.

FESAC discussion: It was noted that part of the charge asks about HEDLP energy applications, and this was described in terms of target issues. The Priorities, Gaps and Opportunities panel had a broad view, and would this also be the case for this charge? Dr. Fonck said that it would be more restrictive to the underlying scientific issues. He also noted that the next step beyond NIF is not a DEMO-like facility, and it is not clear what this step should be. It was noted that the Priorities, Gaps and Opportunities panel operated under the assumption that ITER was successful; is ignition in NIF clearly defined, and does it mean fast ignition must be proven, or assume direct drive? Dr. Deeney said that either direct or indirect drive is planned for ignition, with fast ignition a backup. It is hoped that ignition will be demonstrated in NIF by 2014. A concern was expressed that the joint HEDLP program could suffer some of the problems that affected the joint NSF-DOE program in basic plasma science. Dr. Fonck replied that the problem with the joint NSF-DOE program was that it overlapped with other agencies. This is not the case for the joint HEDLP program. Dr. Deeney added that a lot of discussion was involved to craft and define the areas of interest for the joint HEDLP program. A question was asked on the size of the joint program in terms of funding, and if the agencies will be matching funds. Dr. Fonck replied that in FY 2008 there is \$18M in the redefined program. For FY 2009, this would increase to \$24M. The hope is that over time both agencies will contribute on the same scale.

Appendix: public attendees.

Ray Orbach, DOE SC
Tom Vanek, DOE SC
Pat Dehmer, DOE SC
Joanne Wolff, DOE SC
Rich Hawryluk, PPPL
Stephen Dean, Fusion Power Associates
Dale Meade, Fusion Innovation Research
and Energy

Mark Haynes, GA
Miklos Porkolab, MIT
Ed Synakowski, LLNL
Moe Khaleleel, Pacific Northwest Nat. Lab.
Shirley Gill, ArevaFed Svc.
Alison Fox, MIT
John Henry Scott, OSTP
Chris Deeney, NNSA, DOE, NAIB

Linda Blevins, DOE
George Tynan, UCSD
Michael Roberts, Roberts International
Kate Beers, OSTP
Ron McKnight
Dan Lehman, DOE SC
Stan Milora, ORNL
James Van Dam, UT-Austin
Rob Goldston, PPPL
Steve Knowlton, Auburn University
Martin Peng, ORNL
Arnold Kritz, LeHeigh University
DOE OFES:
Raymond Fonck
Sam Barish
John Mandrekas
Steve Eckstrand
Gene Nardell
Darlene Markevich
Sharon Stevens
John Glowienka
Jeff Hoy
Al Opdenaker
Francis Thio
John Sauter
Curtis Bolton